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ABSTRACT

The nature of U.S. research universities, which emphasize both graduate education and research, is discussed. Three elements that account for their character and unity are: a commitment to academic values, distinguished faculties, and considerable resource bases and resource flows. Research universities have been classified by different criteria, including those of the Carnegie Classification. In addition to about 20 institutions that are the most prestigious and most involved in high-dollar, big-science research, there is a second tier of research universities that can be distinguished as having generally smaller departments and graduate programs that are not top-ranked in national quality rankings. These institutions can be designated as regional research universities. A third group of research universities (but not necessarily a third or lower tier) consists of flagship state universities, land-grant universities, and large private universities that undertake large amounts of research, but also have substantial amounts of undergraduate teaching. Undergraduate teaching and research at 20 top-ranked research universities are discussed, along with academic values and resources. Current finances at the schools and undergraduate education are also discussed. (SW)

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AMERICAN RESEARCH UNIVERSITIES:

THEIR ROLE IN UNDERGRADUATE EDUCATION

A Background Paper for the Study Group on the

Condition of Excellence in American Higher Education

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
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June, 1984

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RESEARCH UNIVERSITIES

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Yale University
June 1984

The research universities form the best known portion of the American system of higher education, and yet as a group they are probably the least studied. When they are discussed, it is usually in connection with research policy rather than undergraduate education. They nevertheless occupy a strategically vital position in this area, if for no other reason than because they possess the most coveted places for college study and because they educate the country's most gifted students. Clearly their role in undergraduate education deserves attention. First, however, one must grasp the nature of these diverse and multifaceted institutions.

The research universities are the most compartmentalized of institutions in American higher education. The undergraduate college(s) sometimes contains less than half of enrolments, and in most cases would account for a minor portion of the budget. Many of them possess massive, virtually autonomous hospital-medical school complexes, usually on their own separate campuses; the Land-Grant research universities do extensive agricultural development work at various locations; many large research laboratories are almost wholly supported by federal funds and quite remote from any university teaching; and, almost all research universities contain various professional schools, each with its own distinctive orientation. Still, in the true research university the spirit of basic research penetrates into

the academic departments and is an active presence in the life of the institution.

The research universities are known above all for research, naturally, and graduate education. Behind these activities, however, lie three elements that account for their character and their unity. First, they have deep and inescapable commitments to academic values. This is no mere truism. As compartmentalized institutions the research universities have to harmonize commitments to a large number of value sets, not all of which are easily compatible with the norms of academic inquiry. Nevertheless, the predominance of academic values in matters concerning faculty, graduate education, curricula, and of course research is the hallmark of a research university.

Second, these institutions possess faculties that are distinguished in the eyes of their peers. Every research university obviously cannot excel in every department, but peer-rated esteem is a paramount consideration in decisions concerning the hiring, promotion and compensation of faculty.

Third, sustaining a high volume of academic research requires a considerable resource base and resource flow. The research universities are among the wealthiest institutions of higher education--and they need to be. The annual income for research that is largely derived from extenal sources has to be backed up by high overhead expenditures for a distinguished faculty and a large base of research capital embedded in libraries, laboratories and other facilities. Each of these points requires elaboration, but first it should be determined which institutions fulfill these criteria.

The Carnegie Classification of American colleges and universities designated as Research I Universities the 50 institutions that received the largest amounts of federal research funds and trained the most future researchers. The next 50 institutions by these same criteria were dubbed Research II Universities. NCHEMS, using somewhat more restrictive criteria, uses a category of 73 Major Doctoral/Research Universities. In either case, it should be evident that so large a number of universities could not all meet the criteria just given. For conceptual purposes, these so-called research universities might be separated into three groups--one well-defined and the other two somewhat impressionistic.

At the peak of the research university hierarchy I have identified twenty institutions which largely fulfill the criteria just given and which can reliably be taken to represent this type. (Geiger, forthcoming b). Since both total volume of research and commitment to excellence are important for defining research universities, I have combined the rank order lists of universities on both these criteria. Below are the sixteen institutions that had the largest expenditures for research and development during FY 1980 (NSF, 1981); opposite them are the seventeen institutions (because of the tie for sixteenth place) that were rated to have the highest overall faculty quality in the recent Assessment of Research-Doctorate Programs in the United States (1982) (Webster, 1983):

Rank	R&D Expenditures	Faculty Quality	Rank
1.	M.I.T	UC Berkeley	1.
2.	Wisconsin	Stanford	2.
3.	UC San Diego	Harvard	3.
4.	Minnesota	Yale	4.
5.	Stanford	M.I.T.	5.
6.	Washington	Princeton	6.
7.	Michigan	Chicago	7.
8.	Cornell	Michigan	8.
9.	Columbia	Wisconsin	9.
10.	Harvard	UCLA	10.
11.	Penn	Columbia	11.
12.	UC Berkeley	Cornell	12.
13.	UCLA	Illinois	13.
14.	Illinois	Penn	14.
15.	Johns Hopkins	Caltech	15.
16.	Texas	Minnesota	16.
		Texas	16.

(See Appendix: Tables 1 & 2)

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It would be difficult to argue that any of these institutions do not belong in the top twenty, although a reasonable case could be made that several other schools are equally deserving of the last two or three spots. Nevertheless, this list is practical and sufficient for the purpose at hand, and will consequently be used for the rest of this paper as the reference for the discussion of research universities. These universities, moreover, generally act as the spokesmen for research universities (Research

Universities and the National Interest, 1978). They are also diverse enough to represent the gamut of possibilities for this species. Still, it is important to note what is being left out.

A second tier of research universities can be distinguished that are generally smaller, less prestigious in terms of national rankings, and less involved with high-dollar, Big-Science research. This tier would include well-endowed private universities like Brown, Carnegie-Mellon, Case-Western Reserve, the Claremont Group, Duke, Emory, Rice, Rochester, Northwestern, Vanderbilt and Washington University; as well as such state universities as North Carolina, Virginia and Indiana. These institutions largely share the academic values of the first group, and they often have impressive levels of resources relative to their more selective commitments. Their smaller departments and graduate programs, however, do not receive sufficient recognition to place near the top in national quality rankings. These institutions might be designated as regional research universities: they are highly regarded in their respective regions, and thus play an important role in research and graduate education.

A third group of research universities (but not necessarily a third or lower tier) consists of those flagship state universities, Land-Grant universities and large private universities that undertake large amounts of research, but also have obligations for substantial amounts of undergraduate teaching. Their intake of students tends to be relatively unselective, and preprofessional degree programs often have

larger enrolments than academic ones. Usually a considerable proportion of their research expenditures are sequestered in the medical school or devoted to agricultural stations. Academic values are generally present in these universities, and sometimes prominently so; but they tend to be diluted by other important institutional imperatives. These multiple purposes can produce some noticeable incongruities. Texas A&M, for example, has a large and growing R&D budget and a desire to make a mark in Big Science physics research, but at the same time clings proudly to non-intellectual attitudes and patterns of behavior known as the Aggie spirit. On the whole, these institutions tend to rank more highly on measures of research volume than they do on those of faculty quality. The values and attitudes that inform research have a comparatively small impact on undergraduate education.

Unity and Diversity

Research and graduate education are the tasks that unite the research universities as a group. Indeed, these have been the principal interests of the Association of American Universities, which has represented the research universities since the beginning of this century (Geiger, forthcoming a). Their teaching roles, and particularly their undergraduate teaching roles, on the other hand, are the most obvious characteristic by which they differ. The twenty schools considered here, in fact, include both the largest single-campus university in the country (Minnesota) and the most selective one (Caltech). This duality between research and undergraduate teaching corresponds with the cross-cutting of disciplines and institutions that Burton Clark has called the "master-matrix of higher education": "higher

education needs disciplines to concentrate on research and scholarship and it needs universities and colleges to concentrate on teaching and dissemination" (Clark, 1984). The remainder of this section will attempt to partially fill-out this master matrix for the twenty leading research universities. All of the data cited here will be drawn from the statistical appendix to this paper.

The competition for academic prestige is an inherent feature of the university research role. It is rooted in the processes by which scientific recognition is continually alotted and evaluated. It is thus only natural that this preoccupation gives rise to periodic formal rankings, even though such an endeavor is inherently imperfect and controversial. The rank of any university in the academic pecking order is really an abstraction; it is a somewhat artificial aggregation of the prestige of individual departments, which are in turn aggregations of the prestige of individual scholars. Nevertheless, the existence of hierarchy is a reality that affects the behavior of individuals and institutions (Geiger, forthcoming b). The recent Assessment is as thorough and judicious an exploration of this hierarchy as has yet been undertaken (Webster, 1983). Its findings, then, have the virtue of presenting in detailed and nuanced form what everyone knows, or thinks they know, anyway (Table 2).

In the ranking given in Table 2, three strata are discernible among these twenty universities. At the top, seven institutions (Berkeley, Stanford, Harvard, Yale, M.I.T., Princeton & Chicago)

are distinguished by not only an abundance of very strong departments, but also by the presence of numerous excellent departments (those scoring 70 or more, two standard deviations above the mean). Caltech, as a small and specialized institution, clearly belongs in this group as well by virtue of having six departments of this caliber. The next seven institutions constitute a second stratum (UCLA, Michigan, Wisconsin, Columbia, Cornell, Illinois, Penn). They too have a large number of strong departments, but without very many rated as excellent. Below this level the areas of academic strength become more spotty. A third stratum would include more institutions than our remaining five, but many of them would be--like Texas, Washington and Minnesota--very large universities where highly rated departments were the exception rather than the rule. The interesting question then becomes, how do these three levels of academic quality match up with other institutional characteristics? (See Geiger, forthcoming b).

Seven of the eight schools in the top stratum are private. Their most salient common characteristic is the limited size of their undergraduate colleges (Table 6). Harvard is the largest of these universities with more than 15,000 students, yet only about a third of them are undergraduates. As a result of deliberately restricting their undergraduate intake, they have become among the most selective of universities. Median combined SAT scores for entering freshmen approach or exceed 1,300 at all except Chicago (Table 4). Berkeley, although an exceptional case in many regards, also fits this model by having the highest freshman SATs among public universities. Clearly, the

distinguished faculty of these elite schools find teaching small classes of high-ability, well-motivated undergraduates to be a congenial accompaniment to graduate instruction and research.

The universities of the second stratum are remarkably alike. All are fairly large institutions containing numerous compartments or units. The four state universities here naturally have obligations to provide a variety of services. Service roles are present in the three private universities as well: Columbia and Penn have a special relationship to their respective metropolitan areas, which have traditionally been their sources of voluntary support; and Cornell contains units of the State University of New York. The many fine academic departments found at these schools do not have the campus to themselves. The research atmosphere is consequently less rarified at these multi-purpose institutions.

Below the second stratum the effects of bigness and smallness tend to diverge in accordance with the differences already noted between small regional research universities and large multi-universities. The former tend to emulate the top stratum of universities to the extent that their resources permit. The latter are rather unselective in admitting undergraduates, have large teaching burdens, and conduct much of their research outside of their basic academic departments. A comparison of these state universities with the others in the higher strata would seem to suggest an inverse relationship between inclusiveness and academic prestige, although in this and other respects no single pattern will be valid for all twenty of these

institutions.

Every state maintains a flagship university, but the portion of higher education responsibilities that each one bears varies considerably according to circumstances. Particularly important are, 1) the existence of an array of complementary institutions to absorb the demand of less qualified students; 2) whether or not it is a Land-Grant university committed in part to the agricultural and mechanical arts; and 3) whether or not it is located in an urban center, and thus obliged to serve part-time and irregular students.

Minnesota has concentrated more of its higher education burden on its flagship campus than any other state. The University of Minnesota is consequently the largest institution in the country. Among top research universities it has the lowest selectivity, lowest faculty salaries, and the highest percentage of part-time students. The University of Washington has a similar urban location, but is complemented by more vocationally oriented Washington State. Texas, located in the state capital, has simply evolved as a large and inclusive institution. Although the state has a well developed higher education system, UT-Austin has only been able to impose a limited degree of selectivity. Wisconsin-Madison is in a similar situation, and only slightly less massive; but it claims considerably greater academic distinction. In 1971 the Wisconsin Legislature amalgamated all state universities into a single system, but this act of educational leveling has so far failed to diminish Madison's eminence as a research university. Illinois, although a Land-Grant university, is essentially a residential

university and has a correspondingly high level of selectivity. Finally, Michigan is suited by circumstance to have a greater academic orientation than those schools just discussed. As the most selective state university after Berkeley, it serves predominately a resident, full-time, nonvocational body of undergraduate students. The California universities clearly constitute a special case, but one that seems consistent with this pattern.

The great size and resource base of California, together with the practice of centralized planning, have allowed research to be nurtured at the campuses of the University of California and have also permitted an unusual degree of specialization. Berkeley has been an obvious beneficiary of this policy, as the necessary steps have consistently been taken to maintain its preeminence among American universities. The selectivity of its undergraduates and the average salaries of its professors are both the highest for public research universities. UCLA has a quite different character. It could be regarded as the flagship university of the Los Angeles area, with minor state universities in outlying Irvine and Riverside, and nearby Los Angeles State to absorb many lesser-ability students. Its educational mission thus seems to be quite comparable to other state flagship universities. UC San Diego is at once the youngest and most unusual of public research universities. Created de novo in the 1960s with a large, specialized research base in the Scripps Institution of Oceanography, it has managed to develop a number of strong academic departments. Still, this research institute

cum university presents an incongruous combination of elements: a comparatively unselective undergraduate college, a small graduate school, and a massive specialized research arm almost totally supported by federal grants.

The 11 private research universities under consideration are far more diverse than their public counterparts. Nevertheless, a few clusters of somewhat similar institutions are evident. If they were to be placed along a continuum stretching from homogeneity to heterogeneity of function, some significant differences between these institutions would become apparent (Geiger, forthcoming b).

At one extreme, Caltech, M.I.T. and Johns Hopkins could be described as "research-intensive universities." In these schools relatively small enrollments, half of which are graduate level, are combined with relatively large research efforts, thereby producing the highest concentrations of research in relation to teaching to be found in the United States (Table 1). All three specialize in Big-Science fields of engineering and physical science, and Hopkins is a leader in medical research. Chicago belongs in spirit with the research-intensive universities, although it has a rather different institutional profile. It has an unusually small undergraduate college, and a corresponding emphasis on graduate and professional education. Because it concentrates less on the high-dollar physical sciences, its research expenditures are not particularly high. It seems to have maintained a leading role in graduate education with fewer resources than its top-stratum peers.

Harvard, Yale and Princeton form a natural cluster in most people's minds. However, their close similarities in goals, student bodies and educational character pertain perdominantly to the undergraduate colleges. As research universities, Harvard is large with numerous professional schools; Yale is medium-sized with only the principal professional schools; and Princeton is quite small without any professional schools. Each nevertheless stands among the national leaders in the selectivity of its undergraduate college, in the prestige of its graduate school, and in the size of its endowment. By these same criteria, Stanford would now seem to qualify for inclusion with this venerable trio. In educational structure Stanford is most similar to Yale, but with considerably higher research expenditures.

The remaining three private research universities are highly compartmentalized, multi-purpose institutions, although for rather different reasons. In the case of Cornell its original status as a Land-Grant institution has led to the development of a state-supported unit (Statutory Colleges) with corresponding implications of state service. For Columbia and Penn, however, their close involvement with their urban communities have led to the growth of several service roles, particularly in the professional schools. Their multiple functions are nevertheless evident on the undergraduate level. In contrast to the indivisible colleges of H-Y-P, Columbia and Penn have 5 undergraduate units and Cornell has 7.

Values

It is relatively simple to specify the value system of the

research universities, for it is identical with the values of the academic disciplines. In fact, the national or international disciplinary communities and the individual research universities are heavily dependent on one another. The disciplines, through their formal and informal processes of evaluation, assure that contributions to the advancement of knowledge are validated, and that recognition and rewards are allocated to scholars and scientists. The research universities, possessing as they do the most valuable positions and facilities for conducting research, have the obligation of making these opportunities available to the most capable investigators. In theory this would require exemplifying what Robert K. Merton called "the normative structure of science" (Merton, 197). In practice it means awarding faculty positions in accordance with the reward system of science and the judgements of disciplinary peers.

It was stated at the outset of this paper that academic values are by definition predominant on research university campuses. Universities where this is not the case may conduct considerable research, and may qualify as Major Doctoral Universities, but to call them research universities would tend to stretch the term. Research universities bear an implicit responsibility for upholding the norms of science. Indeed, in this respect they provide moral leadership for American higher education as a whole. Other institutions may slight these values on occasion, but the research universities may not. The loyalties of their faculty, the flow of research funds, and much of their indispensible voluntary support depends upon their

fealty to this code. The predominance of academic values, then, is no idle preference: it is an institutional imperative resulting from some distinctive features of our system of higher education.

A good deal of authority in research universities devolves upon academic departments. This is where the expertise resides for exercising academic judgements, and this is where academic values are most strongly felt. In large measure research universities are obliged to defer to their departments in matters pertaining to personnel and subject matter if they wish to retain their most productive and prestigious faculty members. In this respect, the decentralized, competitive structure of American higher education, and the comparatively high degree of mobility that this gives rise to, have major effects upon the behavior of research universities. If an institution wishes to be competitive in the ongoing contest for academic distinction, it must honor the values set by the peak research universities. In addition to this competition for prestige, research universities are also constrained by a more materialistic competition for research funds. Almost all the direct costs of research in American universities come from external grants, and a large proportion of these are awarded on the basis of peer review. Acquiring the basic resources for conducting research year after year, then, also demands that universities retain the loyalties of their grant-winning faculty.

Resources

Howard Bowen has formulated several 'laws' to describe the economic incentives and behavior of colleges and universities:

> In quest of excellence, prestige and influence, there is virtually no limit to the amount of money an institution could spend for seemingly fruitful educational ends. [Thus,] each institution raises all the money it can...[and] spends all it raises (Bowen, 1980, 19-20.

This maxim would fit the research universities best of all. They, in fact, owe their special position above all to their money-raising abilities.

These twenty research universities had expenditures in 1981-82 that averaged $22,580 per FTE student. By way of contrast, the other 52 institutions that NCHEMS classifies as Major Doctoral/Research Universities had per-student expenditures averaging $8,216 (NCHEMS, n.d.). One of the distinguishing features of the leading research universities is that they get and spend relatively large amounts of money.

If direct expenditures for research are removed from the research university per-student average, there still remains $15,692 per-student of university spending. By way of comparison, student tuition in the private universities varied from $6-8,000; and tuition plus state appropriations in the public universities averaged over $7,500 (1981-82). If these sums are taken to represent student-derived revenues (since state appropriations depend partly upon student numbers), it becomes clear that they accounted for only about half of the non-research expenditures of these research universities. Where does the remainder come from? The sources would vary somewhat for each

institution; however, these resources play an especially important role in supporting the research role.

For private research universities these extra revenues come primarily from voluntary support, and secondarily from endowment income which itself largely represents a return on past giving (Table 3). These revenues are probably the best single indicator of the 'wealth' of these universities. The private institutions in the top stratum are by this measure also the wealthiest (excepting Chicago). The sources of voluntary support tend to vary for each institution (Geiger, forthcoming c); although 'development,' as it is euphemistically called, is so highly refined at all of these institutions that they count on substantial sums from every category of benefactor. Nevertheless, a high proportion of alumni giving correlates with a strong, residential undergraduate college; universities in major cities have traditionally looked to local philanthropists; noted engineering schools have tended to encourage corporate contributions; and, the large foundations have traditionally sought to bolster the private research universities generally (CFAR, 1983). It might be noted that the medical complexes of these schools generate and consume enormous sums of voluntary support.

It is a significant development that public universities have substantially increased their development efforts in recent years. Among them, the research universities have met with considerable success. For 1982-83, six of the twenty leading fund-raisers were public universities (Minn., Michigan, Illinois,

Texas A&M, UCLA and Wis.), not including the $100+ million efforts of the California and Texas university systems (Chronicle of H.E., 5/9/84).

While it is true that not all wealthy institutions have chosen to become research universities, voluntary support has been the indispensable component for those that have chosen this route. This is fully evident in the historical evolution of American research universities (Geiger, forthcoming a). The reasons for this, in simplified form, are as follows. Voluntary support has been the principal source of capital for private universities, and a supplemental source for public ones. Large amounts of capital are needed for the infrastructure required to support extensive research. This capital is used for a wide variety of purposes, from erecting laboratories and building library collections to endowing professorships; but, remembering Bowen's law, the more of it the better in the pursuit of excellence in research and education.

It is important to link this dynamic with the role of the federal government--the other principal resource base for university research. The government plays a part in furnishing research capital. The federal role here was particularly prominent in the 1960s, and has certainly declined since. The chief function of the federal government, however, has been to pay the direct costs of conducting university research (including a percentage supplement for the immediate indirect costs). In the late 1960s the percentage of university research supported by federal funds reached 75%; today it is closer to 66%. These funds naturally tend to flow to the institutions with the most

competent faculties and the most complete facilities--in other words, to those with accumulated research capital. Thus, the twenty universities covered here account for about two-fifths of federally funded R&D (Geiger, forthcoming, b).

It would be erroneous to conclude from this discussion that money is the sole resource of importance to research universities. Rather, given the values and traditions of these institutions, their human and material capital, it is dollars that drive the system. Accordingly, financial issues are a perennial preoccupation of the research universities.

The Current Environment

The research universities do not share many of the concerns of other American colleges and universities. Their enrolments will not be affected by the shrinking of college-age cohorts. In fact, most of these schools had more applicants this year than ever before. Similarly, the decline in student aptitudes has had a comparatively small impact on these selective institutions.

Their one common concern arises from the general financial squeeze in undergraduate education. The private research universities set the price ceiling in American higher education each year. They are sorely troubled that the annual tuition hikes tend to restrict their potential student pool on the basis of income rather than ability. Higher tuition also raises their own costs for institutional student aid. Sustaining this extremely costly form of education is a financial juggling act in which something is always about to be lost. In practice, compromises are quietly made to reestablish control. Lately

these have been more likely to favor the Development Office than the Office of Financial Aid.

The top public research universities happen to be found in states that have recently experienced considerable economic distress. California, despite the tax revolt, is probably an exception here, and the University of Texas research effort has been buoyed by its oil-fueled endowment (Science, 4/22/83). But the states of the upper Midwest were hit most severely by the recent recession. The University of Washington may be the research university weakened the most, having experienced a notable exodus of faculty. For schools like Michigan the state indigence has prompted a reorganizational triage, as some weaker areas have been sacrificed in order to preserve academic strengths (Science, 4/15/83).

Voluntary support for higher education in general has been remarkably strong in recent years, despite the turbulence of the economy. From 1975 to 1982 it actually increased on a per-student, inflation-adjusted basis (Chronicle of H.E., 5/9/84). Giving to institutions from year to year is characterized by economists as "lumpy"; however, it would appear that voluntary support to research universities has kept pace with this growth. This constitutes a creditable achievement in light of the acceleration of development efforts across American higher education generally. Alumni remain the single largest source of voluntary support, followed by the category of "non-alumni individuals," which includes most major philanthropists. The most salient recent trend has been an increase in corporate giving to higher education, while the relatively static assets of

foundations have provided a diminishing share of the total. The buoyancy of voluntary support has been a bright spot for higher education in general, and for the research universities in particular. In the longer term, however, one can only wonder how much further this pie can expand.

The ongoing federal support for university research contains an inherently political element that is hard to predict. The current administration had originally intended to make significant cuts in this area, but their actual proposals were considerably mitigated by Congressional resistance (Wilson, 1983; Geiger, forthcoming d). Suddenly, about twelve months ago (approx. Spring 1983), an about-face occurred. Support for university research became fashionable among both Republicans and Democrats. The Reagan Administration is now boasting that federal support for university R&D will increase by 26% in real terms during its tenure (Science, 4/6/84). This, of course, is good news for the research universities, but it has not been sufficient to raise their downcast spirits. The consensus remains that university research faces formidable problems in the years ahead.

The difficulties primarily concern the ecology of the research system and the infrastructure that supports university research. On the first point, it is now abundantly clear that the circulation of academic personnel on which they have long depended has virtually ground to a halt. Academic stars, to be sure, are still in demand; but the normal process by which graduate students become assistant professors and ascend the

academic ladder can no longer be counted upon. Academic immobility is generally bad for science, and it threatens to compound the impending crisis in graduate education. Fewer top students have been choosing graduate school in recent years; the financial backing for those that do is inadequate; and, job prospects for those seeking academic careers are dismal (National Commission on Student Financial Assistance, 1983). In economic terms this may appear to be an inevitable consequence of the overall stagnation of the higher education industry. However, graduate education is a vital component of the total operation of research universities. Worse still, the nation may be losing a generation of scientists and scholars.

More than a decade of consistent pressure on research university finances has taken its toll on the infrastructure that underlies the research enterprise. In particular, those things that bear indirectly on research and education have suffered comparative neglect as universities have scrambled to meet immediate needs. The research universities themselves have taken the initiative to focus greater attention on these needs through a "Report from Fifteen University Presidents" (Research Universities and the National Interest, 1978) and a study commissioned by the AAU (Rosenzweig, 1982). Besides the problems besetting graduate education, both documents stressed the following areas.

Facilities and instrumentation: university scientists are increasingly having to work with tools that have fallen well behind the state of the art. The scientific leadership of the research universities seems to be imperiled by the scarcity of

capital for these purposes (cf. Wall Street Journal, 5/31/84).

University research libraries: these "laboratories of the humanities" are losing ground on two fronts: they generally lack the funds to acquire books and periodicals as comprehensively as they have in the past; and, capital is needed to adapt to the new informational technologies that will increasingly shape the future.

International and Area Studies: perhaps the outstanding examples of subjects that do not pay for themselves in terms of student enrolments. Yet, these fields have considerable importance for broadening intellectual contacts within the university and cultivating precious expertise for the nation. They have consequently been developed and sustained largely through external funds. Now, these sources are limited, and universities are finding it difficult to make their own necessary contribution in order to sustain these efforts.

"Of the needs of the university there is, indeed, no end," lamented Harvard's Lawrence Lowell in 1920 (Geiger, forthcoming a). Currently, it would seem, the research universities are faced with difficult choices over which of their many needs they will be able to meet.

Undergraduate Education

At the nation's first research university, Johns Hopkins, physicist Henry A. Rowland was once asked what he intended to do with the students in his laboratory: "Do with them? Do with them?" he replied with some annoyance, "I shall neglect them!" (Hawkins, 1960, 218). In the 100 years since, the stereotype has

prevailed that research university faculty tend to neglect undergraduate students in favor of pursuing their own investigations. Probably any academic could cite examples to support or contradict this view, but as a generalization about research universities it is on the whole misleading. The original Johns Hopkins found that it could not dispense with undergraduate education, and research universities that have faced the issue since then have reached the same conclusion (Geiger, forthcoming, a). In fact, undergraduate education has been and remains an important institutional priority.

For state research universities there is no difficulty identifying the significance of undergraduates. Their mission of public service has conventionally been defined largely in terms of undergraduate enrolments. And reasonably so: they constitute the clientele that is most likely to come from and remain in the state. For those private universities that receive a dominant portion of voluntary support from alumni, undergraduates are a valued and valuable resource. The loyalties that inspire this giving lie almost exclusively with classmates and the undergraduate college. Seven private research universities (Columbia, Cornell, Harvard, M.I.T., Princeton, Stanford and Yale) consistently receive more than $10 millions per year from their alumni; while Penn and Chicago fall just short of that mark (Table 5). Also, unlike gifts from other sources, alumni contributions are largely unrestricted in nature. They are consequently a particularly vital source of revenue for this set of universities.

From an historical perspective, the leadership of the research universities in undergraduate education is readily apparent. A history of innovations might be written just from these institutions. It would have to mention the Yale Report of 1828, the utilitarian curriculum at Cornell, Harvard's elective system, high school certificates devised by Michigan, the first summer school at Chicago, selective admissions as implemented at Columbia, and the 1945 Harvard Report on General Education. What Christopher Jencks and David Riesman called The Academic Revolution (1968) stands for the pervasive influence of these institutions on American higher education in general after World War II. Since that was written, the research universities have pointed the way toward a liberalizing of academic requirements and the total abandonment of the university's role of in loco parentis. Clearly, what happens to undergraduate education at research universities has importance for higher education as a whole.

Probably no set of institutions can speak more confidently about excellence in education than these twenty research universities. The reasons should be evident without having to recapitulate what Robert Birnbaum has written in his background paper on state colleges about the different dimensions of excellence. Quality is usually judged by inputs (which can be measured to some extent) rather than outputs (which are far more difficult to gauge). By such criteria the top research universities do well indeed, since they by definition have a prestigious faculty, and because they attract a large share of the nation's brightest students. But, how would they fare if it

were possible to isolate and measure just their educational effects? Well, insofar as high-ability students tend to profit more than others from four years of reading books and attending classes, the research universities would probably prove superior by any value-added criteria too. Other possible measures might include career development, or social and psychological maturation. These nebulous categories, it might be noted, transcend higher education altogether; and even so, there is no reason to think that research universities, particularly those that carefully select their students, would not rate highly here as well.

Although no explicit attempt has been made to measure the educational effectiveness of research universities per se, some of Alexander Astin's conclusions about selective institutions would be applicable. (Astin, 1977). He found that selective institutions had generally positive effects upon their students both during and after their academic careers. Students showed an increased sense of self-criticism and a strikingly high degree of satisfaction with their undergraduate experience. After graduation they were more likely to enrol in graduate school and, in the long term, achieve high earnings. Apparently their education qualified them for positions with good long-range earnings potential (Astin, 1977, 229); or possibly they utilize what they have learned to adapt well over time.

Still, these selective institutions include both research universities and top liberal arts colleges. It would be far more difficult to compare undergraduate education between these two

categories. David Riesman feels that the very top liberal arts colleges "are probably better than the undergraduate divisions of research universities," apparently because their faculties have a greater commitment to teaching (personal communication). Others would tip the balance toward the research universities by virtue of their generally superior faculties. Probably most could agree that these two types embody somewhat different forms of excellence, and that one or the other might be more appropriate for certain kinds of students. Nevertheless, the superiority of the research universities in the hard sciences would remain unchallenged.

What research universities aspire to achieve with their undergraduates actually transcends the realm of quantification and standardized testing. The effort that goes into writing a senior essay, for example, would be unlikely to improve a student's LSAT score. Similarly, the mental attributes that students would ideally assimilate from a research environment--such things as critical thinking, intellectual confidence, sophistication and creativity--cannot be reduced very well to multiple choice answers. It would instead seem advisable to proceed subjectively by first identifying the special features of undergraduate education at research universities, and then exploring the issues to which these qualities give rise.

The commitment to academic values, a distinguished faculty, and the resources to support research are the distinguishing characteristics of research universities, but their effects on undergraduate education are difficult to pin down. The value system seems to create an atmosphere that influences most

undergraduates. Partly this would be due to the intellectual example set by the faculty; partly also to the effects of intellectually active peers (although to point this out is tautological). Perhaps less evident is the fact that undergraduates at research universities are not the sole institutional raison d'être, but rather form one component of a large and complex organism. They coexist with numerous graduate students, a faculty that is on campus most of the time, full-time researchers, and an ill-defined body of affiliated individuals. A research university is not, like some campuses, a youth ghetto; and the anti-intellectual attitudes that sometimes thrive in such adolescent milieu accordingly have less appeal.

The existence of this complex organism, and the extensive resource base that supports it, produce an extraordinary range of opportunities for students. So great are the offerings at most research universities that more than a modicum of intellectual curiosity could be a positive detriment to class work. Thus, only a fraction of these opportunities can be realized by the average undergraduate. This, however, is the nature of a research university; a movable feast where the delicacies far outstrip the appetites of the guests. Nevertheless, sampling some of these offerings, and just becoming aware of the existence of others, can in itself be an important component of a student's education. In these kinds of opportunities research universities are unequaled. The research universities typically do not require, or necessarily promote the involvement of their students in these many activities, but rather make them available on the basis of individual choice.

Much the same could be said about classroom instruction. In general these schools have modest student/teacher ratios. Small classes and close involvement with the faculty are thus available to students who are inclined to seek these things. The situation is similar regarding course offerings. The extensive range of the curriculum allows students great freedom to pursue their intellectual interests if they so choose.

What has just been said requires a major qualification: the character of undergraduate education at research universities varies considerably according to the mix of students. Indeed, this is probably the paramount factor. Each of these schools recruits a substantial number of very high-ability students. What varies is the number and the aptitudes of their classmates.

The research-intensive universities (Caltech, Hopkins, M.I.T.) undoubtedly have the most homogeneous student bodies, because their small classes are recruited almost solely on the basis of academic abilities. The educational philosophies on these campuses encourage raising these gifted students to the level of advanced work as quickly as possible. Interestingly, all three schools allow some or all of the Freshman year to be taken on a pass-fail basis--recognition, in effect, of the preliminary nature of such work. They also make it a regular practice for undergraduates to participate in faculty research projects. The peer culture at these schools is obviously highly intellectual. For gifted and motivated students committed to scientific careers, it is difficult to imagine a better learning environment or a more effective education. However, there is no slow lane on these fast tracks.

At Harvard, Princeton, Stanford and Yale a somewhat different approach to undergraduate education prevails. These schools long ago committed themselves, not to choosing the brightest students according to grades or SATs, but to selecting a diversified class from among their many qualified applicants. Exactly how each school does this is an institutional secret, although the general rules are evident. The point is that each member of these painstakingly constructed freshmen classes has the oportunity for one of the best undergraduate educations--in terms of faculty, facilities, peers and environment--that this country has to offer. The undoubted excellence of these schools, however, is a privilege available by its very nature to only a few.

Public research universities have a mandate to make their resources available to a far more numerous clientele. "We will support your ambitions to be a world-class research university if you will look after our bright children," is the way Martin Trow has characterized the unwritten compact between the State of California and Berkeley (Trow, 1983). Because of the numbers involved, this clearly has a dilutive effect. Thus, a world-famous scholar is more likely to be encountered in the lecture room than in a seminar. The trade-off here is that more students will hear the professor, but fewer will have the opportunity for close interaction. The positive benefits of this approach should not be deprecated by comparisons with highly selective private institutions. These universities cater to many students who are not quite up to the demanding pace of elite institutions. Many of these are able students who undoubtedly learn far more than

they would in a less rigorous environment. Thus, the advantages of a research university are spread more widely at these state institutions. The role of voluntarism, however, is especially significant here. On large campuses dominated by undergraduates, a student often has to exert greater effort in order to profit from the opportunities that a research university makes available.

The research university ambiance probably contributes to the effectiveness of undergraduate education most markedly at the selective public institutions like Berkeley and Michigan. Fairly good academic skills and a degree of intellectual curiosity are the prerequisites for reaping the benefits that a research university has to offer. At some point, it would seem, dilution can go too far. The research university atmosphere can be overwhelmed by other elements. Specifically, the symbiotic relationship between teaching and the intellectual pursuits of the faculty begins to deteriorate where students lack sufficient preparation and motivation. Perhaps worse, the positive effects of the peer culture can be lost entirely. These conditions tend to alienate research-minded faculty. Note that the state research universities in the third stratum of prestige are also those with the highest teaching burdens of lower division students (Table 6).

The different mixes of students that one finds in the research universities has been stable for a generation, and is unlikely to change in the near future. Each institution responds to the logic of its own situation. Perhaps from the standpoint of the socially optimal utilization of resources the best private

research universities are too good; that is, they concentrate their abundant benefits on too few students. But, they are in competition with one another for excellence, and the rarefied standard to which they aspire precludes increasing their undergraduate enrolments. State university systems, in general, might benefit from greater differentiation--in particular, from protecting the research milieu at flagship campuses. However, higher standards of admission on these campuses would in most cases mean substituting out-of-state students for in-state ones; and diminishing the size without diminishing the budget would be equally unthinkable. Thus, undergraduate education at research universities will likely continue to have two faces, each with its own special attraction.

Caveats and Qualifications

With their many advantages compared to other colleges and universities, the research universities might produce creditable educational results without too great an effort. Yet, they are burdened by an extraordinary responsibility. They have the task of educating a considerable portion of the nation's most gifted youth. If for no other reason, this challenge has prevented research universities from being complacent about undergraduate education.

A perennial issue, which has been felt most acutely at the research universities, has been the tension between general education and the imperatives of specialization. "Imperative" is not an overly strong term in light of the rapid proliferation of disciplinary knowledge, not to mention the growth of hibred

and interdisciplinary fields. Yet, the desire has remained strong to provide undergraduates with some acquaintance with all the major areas of human knowledge, and a common cultural experience (Bell, 1966). The conflict continues today, as indicated by the controversy surrounding the implementation of a Core Curriculum at Harvard. General education, nevertheless, is probably weaker today than ever. The problem is not the implacable advance of knowledge, but rather some fundamental weaknesses in the concept itself. The first of these is cultural relativity: what one generation decides are the verities of our cultural heritage and the accoutrements of all educated people, rarely is accepted as such by the next generation. This can be amply demonstrated by merely reviewing past definitions of general education (Bell, 1966). Second would be the current absence of consensus over what the specific content of general education ought to include. (Harvard took refuge here in "modes of reasoning.") Third, there seems to be no compelling evidence that institutionalized general education (as opposed to virtuoso individual performances) can actually achieve the cultural and cognitive attainments that its proponents claim as justification.

Most disciplinary faculty, despite spasms of guilt about specialization, have little use for general education courses. It is often alleged that this is because such courses distract them from their research, or because they involve too much preparation. If one does not wholeheartedly endorse the premises of these courses, however, teaching them can be intellectually dishonest. The more closely prescribed the course, the greater the problem. It is also telling that the better students tend to

desert the general education offerings because they find greater stimulation in the disciplines (once called the Exeter syndrome at Harvard). For these reasons, then, the undying impulse to ensure breadth and culture in undergraduate education has been transmuted in most research universities into distribution requirements. The permutations here are limitless, but in essence this solution harmonizes the interests of the disciplinary faculty with the consciences of the deans.

Are teaching and research complementary activities? Or, do the time-demands of research and the diversion of intellectual energies inevitably occur at the expense of classroom pedagogy? These fundamental questions have been debated throughout the history of research universities. Proponents can of course still be found on both sides. After all, for every Henry Rowland one can find an Ira Remsen--Rowland's colleague in chemistry who was a dedicated and well-liked teacher. It nevertheless seems to this writer that in the long run active scholars at research universities are likely to be the most effective teachers for academically competent students. Surely what is taught should ultimately take precedence over the way in which it is presented. Actual involvement in research is still the most feasible and most natural way for a professor to keep abreast of his or her field. Furthermore, this activity is the surest means of sustaining intellectual enthusiasm towards ones subject over the duration of a teaching career. As a practical matter, research university faculty teach fewer hours per semester and fewer semesters over the years. They are consequently likely to be

somewhat fresher in the classroom than faculty with unrelieved teaching burdens. Still, the synergy of teaching and research cannot be taken for granted.

Recently, two well-informed individuals independently expressed their judgements to this writer of the superior quality of undergraduate education at Yale. The reasons given were the effectiveness of the Yale Colleges in uniting living and learning, and the value placed upon teaching by the Yale faculty. The first of these conditions would be impossible for most schools to duplicate (although Princeton and Penn are attempting to move in this direction); but the second would not. Yale faculty are scrupulous about meeting their classes and conscientious about their presentations. This tradition of strong teaching is recognized and encouraged institutionally; and Yale students, having been accustomed to good teaching, are a demanding audience. On research university campuses where teaching does not have this type of backing, a kind of entrepreneurial spirit can potentially distract faculty from their obligations toward students. It is not research itself that causes problems, but rather the accumulation of excessive obligations to disseminate, market or otherwise exploit one's accomplishments. A telling symptom of this syndrome would be famous professors who are rarely on campus to teach. A worse consequence would be courses that are perfunctorily given, with frequent cancellations, by jet-set professors.

Wayne C. Booth recently articulated a rather different concern: he feared that the research mentality was often an outright obstacle to facing up to the obligations of teaching

beginning undergraduates (Booth, 1983). This situation may be particularly acute in English Literature, where scholarship tends toward the esoteric, and where the disjunction between the goals and the reality of freshman comp. can be enormous. Booth does not go so far as to endorse the position of some teaching purists who disdain scholarship entirely. Rather, he calls for scholarship that could and would be utilized by teachers. More generally, Booth essentially warns that the synergy can be lost when either teaching or research are overemphasized.

There has been widespread concern for more than a decade about increased government involvement in higher education and the decline in university autonomy that this has caused. These issues are of special concern to research universities because their nature requires the constant exercise of critical judgement. The bureaucratic procedures that tend to be imposed by government are inherently antithetical to such judgements. Since the impact of the autonomy question on undergraduate education is largely indirect, it should be sufficient simply to list these well-publicized issues:

--The Buckley Amendment giving students access to formerly confidential references, thereby short-circuiting the communication of evaluative judgements.

--The application of "Sunshine Laws" to some state universities, thus removing confidentiality from delicate hiring procedures.

--Increasing judicial involvement in personnel questions, especially those involving promotion to tenure. Recently, a spate of court cases have challenged university disciplinary practices as well.

--The still unsettled effects of Title IX of the Education Amendments of 1972 on intercollegiate athletics.

--Affirmative action requirements.

--The ongoing battle over accountability for federal funds.

One unintended consequence of the growth of government regulation has been to stimulate a long-term trend toward the enlargement of university administrations. A Yale faculty report has ruefully noted that since 1970 the Arts and Sciences faculty there has decreased by 7%, while the number of administrators increased by 30%.

In light of the past leadership of research universities in undergraduate education, it would be interesting to chart the present currents of change; that is, to illuminate those problems that the research universities themselves have identified and acted upon. Any conclusions in this area would have to be highly tentative; however, there does seem to be an evident concern for academic strengthening.

Harvard, Princeton, Stanford and Yale, as noted above, represent the <u>crème de la crème</u> in undergraduate education. They have not only been consistently concerned about optimizing the educational experiences of their students, but these fortunate

these fortunate institutions possess the wherewithal to undertake significant changes when they so choose. These schools seem to be attempting, without trying to turn the clock back, to overcome some of the permissive and fissiparous developments of the late sixties and early seventies. At Harvard this has meant, above all, instituting the Core Curriculum--the latest and in many ways the most reasonable pendulum swing toward general education. Yale recently reinstated the foreign language requirement; however, behind that step lies a consistent effort to strengthen academic standards by reducing grade and credit-hour inflation, taking a hard stand against plagiarism, and promoting writing skills. Both Princeton and Stanford have acted to enhance the educational potential of residential life in the hope of reintegrating the undergraduate college.

Do these isolated steps constitute a trend of significance for American higher education? It is noteworthy that they seem to be placing greater demands upon their students in curricular coverage, in classroom performance and as members of an academic community. They thus are running counter to the consumerism that has plagued many colleges and universities as a result of the heightened competition for enrolments (Riesman, 1982). It also might be noted that academic majors are generally thriving at these schools, in contrast to the tide of vocationalism that has engulfed large sections of American higher education (Geiger, 1980a). Perhaps these disparities mean something.

American higher education today is poised on the edge of a dramatic demographic reversal. For more than a decade large

college-age cohorts expanded FTEs. These fat years for colleges and universities, however, were lean ones for a large portion of their graduates, who exited into choked labor markets. Students instinctively responded to these conditions by discounting their educational investments, and their lack of commitment had a generally deleterious effect upon educational standards (Geiger, 1980b). The transition to smaller college-age cohorts has the potential for reversing this relationship. A healthy market for college graduates could enhance the pay-off for quality in higher education. In fact, the demand for places at the best universities is already at its highest levels ever. Thus, it is not entirely far-fetched to conceive of a second Academic Revolution within the coming decade. Like the last, this would be led by the major research universities; but unlike the last, the emphasis might be on fostering excellence in undergraduate education. There has been considerable realignment throughout American higher education in the past decade: it may be time for the "academic procession" to begin marching once again (Riesman, 1956).

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STATISTICAL APPENDIX

American Research Universities:
Their Role in Undergraduate Education

by

Roger L. Geiger

Table 1	Selected R & D Expenditures
Table 2	Faculty Quality Ratings
Table 3	Educational and General Revenues
Table 4	Selected Characteristics
Table 5	Voluntary Support
Table 6	Student Enrolments

Table 1: Selected R & D Expenditures for 20 Research Universities, FY 1980. ($000,000)

	A		B	C	D		E	
	Total R & D	National Rank Order	Federal R & D	Federal R & D for Medicine	B-C	Relative Rank Order	General & Ed. Expenditures 1979-80	% R & D (A/E x 100)
M.I.T.	163.6	1	138.4	1.6	136.8	1	268.3	61
Wisconsin	138.2	2	89.4	25.1	64.3	3	352.9	39.2
UC San Diego	124.8	3	111	26.3	84.7	2	285.8	43.7
Minnesota	119.1	4	68.5	33.9	34.6	19	437.9	27.2
Stanford	113.1	5	102.6	40.7	61.9	4	318.4	35.5
Washington	111.9	6	93.1	36.8	56.3	6	329.5	34
Michigan	111.3	7	75.6	21	54.6	8	400.1	27.8
Cornell	107.6	8	70.6	19.1	51.5	9	299.7	35.9
Columbia	101.4	9	83.7	36.1	47.6	13	302.2	33.4
Harvard	100.9	10	76.4	20.5	55.9	7	E426.3	23.7
Penn	94.2	11	70.6	21.4	49.2	11	395.2	23.8
Berkeley	90.4	12	64.1	6.3	57.8	5	310.5	29.1
UCLA	88.9	13	70.4	23.5	46.9	14	541.4	16.4
Illinois	88.3	14	52.8	2	50.3	10	E318.2	26.2
Johns Hopkins	83.2	15	72.8	35.1	37.7	16	205.4	40.5
Texas	78.6	16	48.7	neg.	48.7	12	235.8	33.3
Yale	71.4	22	63.6	28.3	35.3	17	224.8	31.8
Chicago	58.4	30	50.1	15.4	34.7	18	291.1	20.1
Caltech	43.3	39	38.3	neg.	38.3	15	76.3	56.7
Princeton	27.8	69	20.9	neg.	20.9	21	98.1	28.3

Source: Academic Science, FY 1980, (NSF, 1982).

Table 2: Faculty Quality Ratings [b]

National Rank Order	Institution	Phys. Sci., Math	Hum.	Eng.	Biol.	Soc. Sci.	Programs Rated 60 or Higher	Programs Rated 70 or Higher	TOTAL SCORE
1	Berkeley	6	9	4	4	7	30	15	45
2	Stanford	6	4	4	4	6	24	10	34
3	Harvard	5	5	-	4	6	20	12	32
3	Yale	6	7	-	6	6	25	7	32
5	M.I.T	5	2	4	3	3	17	12	29
6	Princeton	5	7	4	-	5	21	7	28
7	Chicago	5	4	-	4	7	20	7	27
8	UCLA	5	5	2	6	6	24	-	24
8	Michigan	2	6	3	4	6	21	3	24
8	Wisconsin	5	3	2	5	6	21	3	24
11	Columbia	5	6	-	4	6	21	2	23
11	Cornell	6	6	3	4	3	22	1	23
13	Illinois	4	2	4	4	3	17	2	19
14	Penn	2	5	1	3	5	16	1	17
15	Caltech	4	-	4	1	-	9	6	15
16	Minnesota	3	-	2	2	4	11	2	13
16	Texas	3	3	3	2	2	13	-	13
20	Washington	2	-	1	5	2	10	-	10
21	UC San Diego	2	2	-	3	1	8	-	8
30	Johns Hopkins	-	1	1	1	2	5	-	5

SOURCE: Adapted from Webster, 1983.

Table 4: Selected Characteristics, 20 Research Universities, 1979-80.

	A Average Salary Professor 1981-82	B % Graduate & Professional	C Undergraduate Selectivity: Verbal & Math SAT Medians	D Non-Research Per Student Vol. Support (Table 5 B+D-G) Table 4 A
Caltech	$45,700	52	1,400	$8,836
Chicago	42,700	68	1,257	4,123
Columbia	42,100	62	1,285E	3,163
Cornell	39,700	30	1,236	1,507
Harvard	48,500	58	1,300+E	6,250
Johns Hopkins	43,100	62	1,296	3,956
M.I.T.	43,500	48	1,355	4,536
Penn	42,900	51	1,290	1,596
Princeton	42,000	24	1,310	6,313
Stanford	46,000	44	1,290	4,605
Yale	44,800	46	1,360	6,023
Berkeley	42,800	31	1,240E	360E
UCLA	41,800	33	1,040E	477E
UC San Diego	40,700	18	1,090	612E
Illinois	38,600	22	1,120E	353
Michigan	39,800	37	1,130	500
Minnesota	33,400	23	980E	630
Texas	38,700	22	1,050	312
Washington	37,800	26	1,070	350
Wisconsin	35,300	28	1,000E	333

Source: Fall Enrollments in Higher Education, 1979, (NCES, 1982)
Academe, 68,4 (July, 1982).

E = Estimated